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ABSTRACT

The course outline has been prepared as a guide to assist the instructor to plan systematically and to present meaningful lessons programmed to meet the necessary training needed by the machine shop student who has completed an introductory course in machine tool technology. The five blocks of instruction contained in this outline are designed to enable the student to obtain the manipulative skills and related knowledge necessary to understand and use drills, threading tools and equipment, power saws, and tool grinders correctly, safely, and productively. The course consists of 135 clock hours. A three-page bibliography is included, and a posttest and answer key are appended. (Author/AJ)

VT

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

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Course Outline
MACHINE SHOP WORK - INTERMEDIATE - 9555
(Bench Work and Support Operations)
Department 48 - Quin 9555.02

CE001939

DADE COUNTY PUBLIC SCHOOLS
DIVISION OF INSTRUCTION • 1973

D A D E C O U N T Y P U B L I C S C H O O L S

1 4 5 0 N O R T H E A S T S E C O N D A V E N U E

M I A M I, F L O R I D A 33132

Course Outline

MACHINE SHOP WORK - INTERMEDIATE - 9555
(Bench Work and Support Operations)

Department 48 - Quin 9555.02

county office of

VOCATIONAL AND ADULT EDUCATION

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Dr. E. L. Whigham, Superintendent of Schools
Dade County Public Schools
Miami, Florida 33132

December, 1972

Published by the School Board of Dade County

Course Description

9555	48	9555.02	Bench Work and Support Operations
State Category Number	County Dept. Number	County Course Number	Course Title

This quinmester course develops the basic skills and supplies the required related machine shop knowledge as the student performs the various work operations needed to complete a project that requires proper laying out, cutting, drilling, and tapping methods. This is the second quinmester course to be taken in the first year of the vocational machine shop course.

Indicators of Success: Prior to entry into this course, the student must display mastery of the skills indicated in Introduction to Machine Tool Technology (9555.01).

Clock Hours: 135

PREFACE

The following quinmester course outline has been prepared as a guide to assist the instructor to plan systematically, and to present meaningful lessons programmed to meet the necessary training needed by the machine shop student.

This is the second course of instruction in machine shop work. The five blocks of instruction contained in this outline are designed to enable the student to obtain the manipulative skills and related knowledge necessary to understand and use correctly drills, threading tools and equipment, power saws, and tool grinders in a safe and productive manner.

The student must complete the first quinmester course, Introduction to Machine Tool Technology, before entering into this second quinmester course, which consists of 135 clock hours.

The methods of instruction vary, depending upon the individual ability of the student. When presenting the subject matter an instructor uses demonstrations, lectures, and question-answer techniques. The learning process is further promoted by the use of models, cutaways, diagrams, audiovisual aids, assignment sheets, unit of instruction plans, job sheets and other types of instructional aids.

This outline was developed through the cooperative efforts of the instructional and supervisory personnel, the Quinmester Advisory Committee, and the Vocational Curriculum Materials Service, and has been approved by the Dade County Vocational Curriculum Committee.

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with Suggested Hourly Breakdown

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GOALS

The student must be able to demonstrate:

1. Proficiency and knowledge of the various methods employed in locating, drilling and reaming holes in metal.

2. Proficiency in the use of taps and dies to produce threads, and the ability to select the proper thread size and form for specific applications.

3. Ability to use correctly and productively the tool grinder, and to select the proper grinding wheels for the various metals to be ground.

4. Ability to use correctly and productively the power saws needed to cut metals into various shapes and forms.

SPECIFIC BLOCK OBJECTIVES

BLOCK I - DRILLS AND DRILLING

The student must be able to:

1. Define and use various drilling machines and operations utilized to machine holes in metal work pieces.
2. List and use the types of drills, reamers, and boring tools utilized to complete various machine operations.
3. Exhibit the ability to select the proper feed and speed required for the various operations used on the drilling equipment by performing the operations.

BLOCK II - THREADS AND THREADING

The student must be able to:

1. List and define the various uses for threads, and state in writing the historical background in their development.
2. Define the terms used to describe threads by listing them on paper, or by oral discussion.
3. Demonstrate skills and knowledge of the methods used for threading by utilizing them in shop projects.

BLOCK III - TOOL GRINDER AND ITS OPERATION

The student must be able to:

1. List and define the types of grinders used for grinding tool bits and various cutting tools in the shop.
2. Demonstrate an understanding of the various methods utilized in the operation of tool grinders, by using them to sharpen and form drills, tools, and work pieces in the shop.

BLOCK IV - POWER SAWS

The student must be able to:

1. Exhibit the ability to operate power saws safely and productively by cutting work pieces to predetermined size and shape.
2. List and define the various power saws used to cut metal in the machining industry.

BLOCK V - QUINMESTER POST-TEST

The student must be able to:

1. Satisfactorily complete the quinmester post-test.

Course Outline

MACHINE SHOP WORK - INTERMEDIATE - 9555
(Bench Work and Support Operations)

Department 48 - Quin 9555.02

I. DRILLS AND DRILLING

A. The Drillpress
1. Safety
a. Work habits
b. Protective equipment
c. Machine condition
2. Uses
a. Drilling
b. Reaming
c. Boring
d. Counterboring
e. Countersinking
f. Tapping
g. Honing
h. Lapping
i. Spot-finishing
3. Basic parts
a. Location and functions
(1) Base
(2) Column
(3) Spindle
(4) Motor and head
(5) Table
(6) Feed mechanism
(7) Quill
(8) Drill chuck
(9) On-off switch
(10) Table-raising crank
(11) Table lock
(12) Depth stop
b. Care and safety
4. Size and capacity
a. Spindle clearance
(1) Column
(2) Base
b. Drill
(1) Size
(2) Travel
5. Types
a. Uses and capacities
(1) Upright
(2) Gang
(3) Radial
(4) Multiple-head
(5) Turret
(6) Numerical control
b. Care and safety

B. Drills
   1. Parts
      a. Description
         (1) Point
         (2) Body
         (3) Shank
         (4) Flutes
         (5) Land
         (6) Margin
         (7) Web
      b. Functions
   2. Sizes
      a. Series
         (1) Number
         (2) Letter
         (3) Fractional
         (4) Millimeter
      b. Range
   3. Grinding
      a. Methods and safety
         (1) Lip clearance
         (2) Lip angle
         (3) Point location
      b. Gaging and measuring
   4. Types
      a. Uses, care and safety
         (1) Two-fluted
         (2) Three-fluted
         (3) Four-fluted
         (4) Subland
         (5) Oil hole
      b. Material made of
   5. Hole drilling
      a. Procedure
         (1) Layout
         (2) Center punch
         (3) Select drill
         (4) Holding methods
      b. Safety and care

C. Boring Tools
   1. Types
      a. Uses
         (1) Single point
         (2) Counterboring
         (3) Countersinking
         (4) Combination
      b. Care and safety
   2. Materials made of

D. Reamers
   1. Material allowance
      a. Hole size
      b. Type of reamer

I. DRILLS AND DRILLING (Contd.)

2. General classification
   a. Hand reamers
      (1) Straight-fluted
      (2) Helical-fluted
      (3) Expansion
      (4) Adjustable
      (5) Tapered flute
   b. Chucking
3. Alignment
   a. Importance
   b. Methods

E. Speeds and Feeds for Drilling and Reaming
1. Formulas
   a. Surface feet per minute
   b. Revolutions per minute
2. Factors
   a. Material
      (1) Work
      (2) Tool
   b. Cutting fluid
   c. Machine used
   d. Hole finish desired
   e. Accuracy required

F. Hole Drilling
1. Layout
   a. Tools needed
      (1) Scribe
      (2) Hammer
      (3) Prick punch
      (4) Center punch
      (5) Dividers
2. Work holding devices
   a. Types
      (1) C-clamp
      (2) Vise
      (3) Angle plate
      (4) V-block
      (5) Fixtures
   b. Care and safety

II. THREADS AND THREADING

A. Uses for Threads
1. Fasten objects
2. Transmit motion
3. Transmit power
4. Control movement
5. Permit adjustment

B. Historial Background
   1. Development
      a. When
      b. Where
   2. Method of producing
      a. Hand
      b. Machine

C. Terms
   1. Screw thread
      a. External
      b. Internal
   2. Diameter
      a. Major
      b. Minor
      c. Pitch
   3. Pitch
   4. Lead
   5. Thread
      a. Multiple
      b. Angle
      c. Number
      d. Axis
      e. Height
      f. Design
      g. Classic
   6. Crest
   7. Root
   8. Flank
   9. Engagement
      a. Depth
      b. Length
   10. Form
   11. Material limits
      a. Maximum
      b. Minimum
   12. Basic size
   13. Allowance
   14. Tolerance
   15. Limits
   16. Fit

D. Types of Thread Forms
   1. Uses
      a. Vee
         (1) Sharp
         (2) American national
      b. Whitworth
      c. Square
      d. Acme
      e. Brown and Sharpe worm
      f. Pipe
         (1) Straight
         (2) Tapered
   2. Methods of production

II. THREADS AND THREADING (Contd.)

E. Threading Methods
1. Taps
a. Methods and type
(1) Hand
(2) Machine
b. Care and safety
2. Dies
a. Methods and types
(1) Hand
(2) Machine
b. Care and safety
3. Measurement
a. Methods
(1) Plug gage
(2) Thread micrometer
(3) Ring gage
(4) Snap gage
(5) Three-wire
(6) Special devices
b. Care and safety

III. TOOL GRINDER AND ITS OPERATION

A. Types of Grinders
1. Pedestal
a. Fixed table
b. Tilting table
c. Dry
d. Wet
2. Bench

B. Grinder Operation
1. Safety
a. Eye protection
b. Machine guards
c. Tool rest
d. Defective grinding wheels
2. Grinding wheel selection
a. Types
b. Tuning and dressing
c. Balancing and mounting
3. Work holding devices
a. Hand
b. Holders
c. Rests
d. Collets

IV. POWER SAWS

A. Safety
   1. Protective equipment
      a. Eye
      b. Guards
   2. Set up and cutting precautions
      a. Conditions
         (1) Blade
         (2) Machine
      b. Care

B. Power Saw Operation
   1. Work holding devices
   2. Blade
      a. Selection
      b. Guides
      c. Welding
      d. Adjustment
   3. Speed and feed selection
      a. Type of metal
      b. Finish
      c. Accuracy
      d. Wet
      e. Dry
   4. Cutting
      a. Straight
         (1) Square
         (2) Angular
      b. Contour
      c. Filing
      d. Polishing

C. Types of Power Saws
   1. Uses
      a. Hacksaw
      b. Band saw
         (1) Horizontal
         (2) Vertical
      c. Circular
   2. Care

V. QUINMESTER POST-TEST

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A P P E N D I X

Quinmester Post-Test Sample

Quinmester Post-Test

Name _____ Date _____ Score ____

Multiple Choice Test Items

Each statement needs a word, a figure, or a phrase to make it correct. Only one of the choices listed is correct. Place the letter of the choice you make in the space provided at the left edge of the sheet.

____ 1. The screw thread is an example of what simple machine:

a. Wedge
b. Incline plane
c. Lever
d. Wheel and pulley

____ 2. The thread form most used for producing traversing movements on machine tools such as the lead screw on the lathe is the:

a. Whitworth
b. Acme
c. Square
d. Brown and Sharpe worm

____ 3. The NPT is designated an American standard thread from for what type of pipe thread:

a. Tapered
b. Straight
c. Dryseal
d. Nonpressure

____ 4. In a visual comparison of American National with unified thread forms, the difference is notices in the:

a. Thread angle
b. Pitch
c. Lead
d. Rounded roots and crests

____ 5. If you have a one-inch deep blind hole to tap 1/2-13NC-2, what is the first tap type you should select:

a. Bottoming
b. Taper
c. Plug
d. Pipe

____ 6. If a chart is unavailable, which formula could be used to find the tap drill size needed to produce the hole:

a. TDS=Major Dia.-Pitch
b. TDS=Pitch Dia.-Major Dia.
c. TDS=Minor Dia.-Pitch
d. TDS=Pitch Dia.-Minor Dia.

____ 7. When selecting speeds for power hacksawing one should generally use:

a. Slow speeds for soft materials
b. Fast speeds for hard materials
c. Slow speeds for hard materials
d. Medium-fast speeds for hard materials

____ 8. When power-sawing, what is the minimum number of teeth which should be in contact with the work at all times:

a. 2
b. 3
c. 4
d. 6

____ 9. Generally, soft materials require blades with:

a. Fine teeth
b. Coarse teeth
c. Medium teeth
d. Fine to medium teeth

____10. In band sawing the speed of blade travel is measured in:

a. Inches per second
b. Feet per second
c. Feet per minute
d. Inches per minute

____11. Small sections and thin-walled pieces require a blade with:

a. Fine teeth
b. Medium teeth
c. Coarse teeth
d. Medium to coarse teeth

____12. The variable speed drive mechanism on bad saws requires that the speed be changed only while the machine is:

a. Stopped
b. Running
c. Unplugged
d. Stopped or running

____13. To reduce the drill press spindle hole size for acceptance of a taper shank drill, you should use a fitting called a:

a. Reducer
b. Tapered reducer
c. Transducer
d. Sleeve

____14. What is the standard taper used on taper shank drills:

a. Brown and Sharpe
b. Jarno
c. Morse
d. American Standard

____15. The removal of a tapered shank drill from a drill spindle requires the use of a tool called a:

a. Remover
b. Wedge
c. Drill pin
d. Drift

____16. Drill sizes are designated in how many ways:

a. One
b. Two
c. Three
d. Four

____17. To produce a one-inch hole with a high degree of straightness and accuracy, you should perform which of the following operations:

a. Drill
b. Drill, then ream
c. Drill, then bore
d. Drill, then tap

____18. Although reaming speeds may vary, one generally machine-reams at what percentage of the speed used for drilling:

a. 1/2
b. 2/3
c. Same
d. 1/4

____19. Hand-reaming requires a material allowance at a maximum of:

a. .001"
b. .005"
c. .010"
d. .015"

____20. The feed for a drill refers to the rate of:

a. Advancement into the work per minute
b. Advancement into the work per revolution
c. Surface speed per minute
d. Surface speed per revolution

____21. The exact rpm for drilling is determined by employing the formula rpm =

a. $\frac{CS \times D}{12 \times Pi}$

b. $\frac{D \times Pi}{CS \times 12}$

c. $\frac{CS \times 12}{D \times Pi}$

d. $\frac{CS \times Pi}{D \times 12}$

____22. When using the tool grinder, it is good safety practice to keep the work rest within:

a. 1/16" of the wheel face
b. 3/16" of the wheel face
c. 1/4" of the wheel face
d. 5/16" of the wheel face

____23. The grinding of tungsten-carbide tools requires a wheel composed of:

a. Aluminum oxide
b. Silicon carbide
c. Emory
d. Iron oxide

____24. The operation which fractures drill abrasive grains and removes ground particles between the grains of a grinding wheel is called:

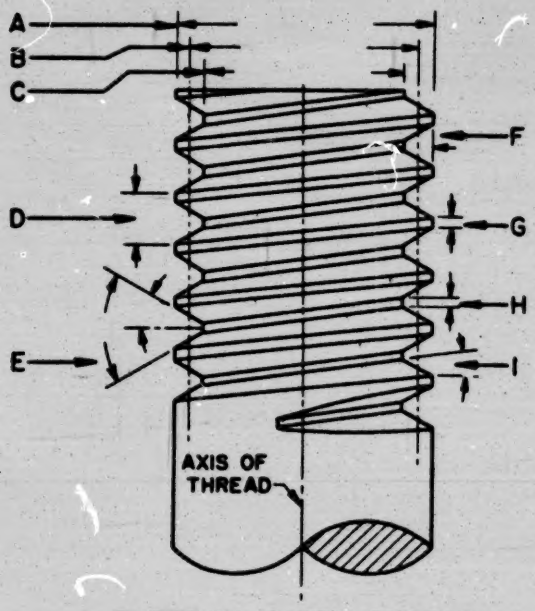
a. Truing
b. Cutting
c. Dressing
d. Scratching

____25. A grinding wheel should not be operated at a speed in excess of the rpm:

a. Marked on the side of the wheel
b. Needed to grind hard steel
c. Needed to dress the wheel
d. Needed to make red sparks

Identification Test Items

Identify the screw thread, drill, and drill press parts shown, by placing the letter pointing to them next to the term which describes each part.



EXTERNAL SCREW THREAD

___ 1. Helix angle

___ 2. Root

___ 3. Crest

___ 4. Thread angle

___ 5. Major diameter

___ 6. Minor diameter

___ 7. Pitch

___ 8. Pitch diameter

___ 9. Thread depth

___10. Lip

___11. Flute

___12. Tang

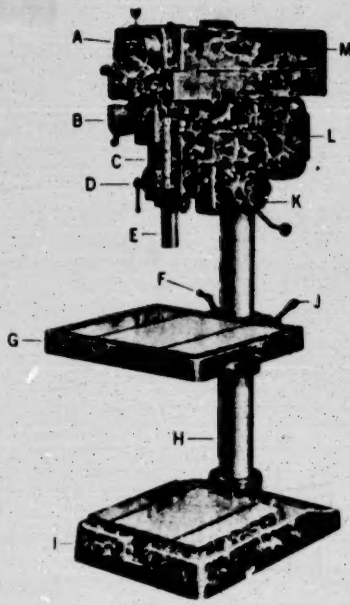
___13. Web

___14. Shank

___15. Land

___16. Margin

___17. Lip clearance



___18. Column

___19. Table lift crank

___20. Guard

___21. Base

___22. Power feed

___23. Switch

___24. Table lock

___25. Motor

___26. Speed control

___27. Head

___28. Spindle

___29. Table

___30. Quill lock

ANSWER KEY TO QUINMESTER POST-TEST

Multiple Choice Test Items

1. b
2. c
3. a
4. d
5. b
6. a
7. c
8. a
9. b
10. c
11. a
12. b
13. d
14. c
15. d
16. c
17. c
18. b
19. b
20. b
21. c
22. a
23. b
24. c
25. a

Identification Test Items

1. I
2. H
3. G
4. E
5. A
6. C
7. D
8. B
9. F
10. F
11. C
12. A
13. G
14. B
15. D
16. E
17. H
18. H
19. F
20. M
21. I
22. K
23. B
24. J
25. L
26. A
27. C
28. E
29. G
30. D